Pertussis

(Also known as Whooping Cough)

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1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Pertussis is caused by *Bordetella pertussis*, a fastidious, gram-negative, pleomorphic bacillus.

B. Clinical Description

Pertussis begins with mild upper respiratory tract symptoms (catarrhal stage, lasting about 2 weeks) and can progress to severe paroxysms of cough (paroxysmal stage, lasting about 2 weeks), often with a characteristic respiratory whoop, followed by vomiting. Fever is absent or minimal. Symptoms wane gradually (convalescent stage). The clinical presentation of pertussis is variable and its diagnosis challenging. Disease in infants younger than 6 months of age may be atypical; apnea is a common manifestation and whoop often is absent. Older children and adults also can have atypical manifestations, with persistent cough and no whoop, or they may present with more classical symptoms. Physicians should include pertussis in their differential diagnosis for patients in all age groups who present with a prolonged cough illness. The duration of classic pertussis is 6 to 10 weeks; however, more than half of the primary cases last < 6 weeks, and a quarter of the patients have cough for $\leq$ 3 weeks. Pertussis is most severe when it occurs during the first year of life (particularly for preterm infants). Complications include seizures, pneumonia, encephalopathy, and death. The differential diagnosis for pertussis includes parapertussis, mycoplasma, chlamydia, respiratory syncytial virus (RSV), and adenovirus. Please refer to Section 2) B. below for guidance on diagnostic tests.

C. Reservoir

Humans are the only host.

D. Modes of Transmission

Pertussis is transmitted person-to-person by direct or droplet contact with nasopharyngeal secretions of an infected person.

E. Incubation Period

The incubation period is usually 7–10 days, with a range of 6–21 days.

F. Period of Communicability or Infectious Period

- **If not on antibiotics:** from 2 weeks before to 3 weeks after cough onset.
- **If on antibiotics:** from 2 weeks before cough onset through the 5th day of treatment.

G. Epidemiology

Pertussis occurs worldwide. It is endemic, with peaks occurring every 2–5 years. Pertussis exhibits no distinct seasonality in the US as a whole, although in Massachusetts the months of greatest prevalence are October–December. Asymptomatic infection (carriage) has been demonstrated and may play a role in transmission. Pertussis is highly infectious, with secondary attack rates of 70–100% among unimmunized household contacts.

Widespread immunization with pertussis vaccine since the 1940s is primarily responsible for the current relatively low morbidity and mortality from pertussis in the U.S. However, incidence has been increasing since the early 1980s, most strikingly in adolescents and adults, who may serve as a source of infection for infants and under-immunized preschool children. This may be due to waning immunity in vaccinated individuals. In recent years, over 90% of confirmed cases in our state have occurred in individuals 11 years of age and older.

Protection after DTP/DTaP vaccination wanes and is absent 12 years after the last dose, which is usually given at kindergarten entry. No vaccine is currently licensed for use in those ≥ 7 years of age. Until acellular pertussis vaccines are licensed for use in adolescents and adults, the current epidemiologic trends will continue. Previous studies have shown acellular pertussis vaccines are both safe and immunogenic in older age groups. Clinical trials are currently underway to further evaluate safety and efficacy.

2) REPORTING CRITERIA AND LABORATORY TESTING SERVICES

A. What to Report to the Massachusetts Department of Public Health

- A case of pertussis confirmed by any of the following laboratory methods:
  - isolation (culture) of *Bordetella pertussis* from a clinical specimen, or
  - a positive polymerase chain reaction (PCR) for *B. pertussis*, or
  - a positive pertussis serology **performed at the Massachusetts State Laboratory (SLI)**, or
- A case of cough illness lasting ≥ 2 weeks with ≥ 1 of the following symptoms: paroxysms of coughing, whoop, or post-tussive vomiting, *and* occurring in a contact of a *laboratory-confirmed* case of pertussis, or
- A case of cough illness lasting ≥ 2 weeks (with *or without* additional symptoms) occurring in a contact of a laboratory-confirmed case of pertussis in an outbreak setting (an institutional setting, *e.g.*, school) with ≥ 5 clustered cases, or a household setting with ≥ 1 case)

Please note that pertussis serology results are not valid for a case confirmation unless the test is performed at the SLI. See the following section (2B) about what kind of retesting (if any) is appropriate for a patient with a positive pertussis serology result from a different laboratory.

B. Laboratory Testing Services Available

There are three types of acceptable diagnostic tests for pertussis:
Culture: available at Massachusetts State Laboratory Institute (SLI) and some diagnostic laboratories.

Serology: only those assays performed at SLI are acceptable. *Note: results from other laboratories are not considered interpretable by the Massachusetts Department of Public Health (MDPH) or Centers for Disease Control and Prevention (CDC).*

Polymerase chain reaction (PCR): performed at several laboratories but not at SLI.

The reliability of each test depends on the age of the patient and the stage of the disease during which the specimen is collected. Culture and PCR are sensitive in the catarrhal stage and when cough has been present ≤ 2 weeks, but after that time false negative results can occur. In contrast, the SLI serologic assay, a single-serum assay for IgG to pertussis toxin, is most sensitive *after* 2 weeks of cough. Culture and serologic testing are available at no charge at SLI; PCR is not. Culture and SLI serology should be used as follows:

Criteria to Use in Selecting Diagnostic Method

Duration of cough	Children (< 11 years of age)	Adults (≥ 11 years of age)
≤ 14 days	Culture only[1]	Culture only
> 14 days	Culture only[1]	Serology only

[1] Serology is not interpretable in children < 11 years of age.

Pertussis diagnostic kits for culture and serology can be ordered from the SLI by calling (617) 983-6604. Because culture test kits have a short shelf life (two months), only the quantity to be used immediately should be ordered. Instructions about how to collect specimens are included in the kits. The requisition form should be filled out *completely* and mailed back with the specimen(s). Both culture and serology take several days to conduct.

3) DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify sources and sites of transmission, and any additional cases.
- To identify exposed persons, assure timely administration of antimicrobial prophylaxis, and prevent further spread of the disease.
- To monitor the effectiveness of outbreak control strategies.
- To provide data to allow the effectiveness of new vaccine formulations and sequences.
- To monitor the possible emergence of antimicrobial resistance and identify any other important changes in circulating *Bordetella pertussis* organisms.

B. Laboratory and Healthcare Provider Reporting Requirements

Refer to the list of reportable diseases (at the end of this manual's introductory section) for information.

C. Local Board of Health Reporting and Follow-Up Responsibilities

1. **Reporting Requirements**

Massachusetts Department of Public Health (MDPH) regulations (*105 CMR 300.000*) stipulate that each local board of health (LBOH) must report the occurrence of any case of pertussis, as defined by the reporting criteria in Section 2) A above. Current requirements are that cases be reported to the MDPH Division of Epidemiology and Immunization, Surveillance Program using an official MDPH *Pertussis Case Report* form (in Appendix A). Refer to the *Local Board of Health Reporting Timeline* (at the end of this manual's introductory section) for information on prioritization and timeliness requirements of reporting and case investigation.

2. **Case Investigation**

a. Pertussis follow-up is sometimes undertaken by the board of health, sometimes by the MDPH, depending on the capacity of the local board of health. In either case, a *Pertussis Case Report* form (see Attachment A instructions on filling out the case report form) and contact worksheet (Attachment B) are used to collect the necessary information. Both attachments are located at the end of this chapter. The *Pertussis Case Report* form is located in Appendix A. Detailed guidelines on case investigation and disease control are given in Section 4: Controlling Further Spread below. MDPH staff are available to conduct trainings in pertussis follow-up for local board of health officials.

After completing the case report form, attach labs reports and mail (in an envelope marked "Confidential") to the MDPH Division of Epidemiology and Immunization, Surveillance Program. The mailing address is:

MDPH, Division of Epidemiology and Immunization
Surveillance Program, Room 241
305 South Street
Jamaica Plain, MA 02130

b. Initial Questions to Ask Healthcare Provider and Patient

In order to assess the likelihood that a suspect case is a true case prior to laboratory testing, MIP and/or other public health staff helping in the investigation should ask about: 1) symptoms, including cough duration; 2) pertussis immunization history, especially for those < 11 years of age; and 3) whether there was any recent contact with anyone with similar symptoms.

4) CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (*105 CMR 300.200*)

The Isolation and Quarantine Requirements (promulgated November 1998, printed July 1999) are out of date. Current recommendations of CDC and MDPH (as of 2000) are as follows:

Minimum Period of Isolation of Patient

Until 21 days from onset of cough, or 5 days after initiation of appropriate antibiotic therapy.

Minimum Period of Quarantine of Contacts
If the contact is symptomatic, then use same restrictions as for cases. If the contact is an asymptomatic healthcare worker not receiving antibiotic prophylaxis, then exclude from the workplace for 21 days after last exposure or, if unknown, for 21 days after the onset of the last case in the setting. If the contact is asymptomatic, not a healthcare worker, and exposed within the last 21 days, s/he should receive antibiotic prophylaxis but no exclusion is generally required.

Note: In certain situations deemed to be high-risk, MDPH may require exclusion of asymptomatic contacts not receiving antibiotic prophylaxis and/or other contacts, and/or may extend the exclusion period beyond 21 days up to a maximum of 42 days.

Please refer to Section 4) B. 5 [page 6] on immunization of children < 7 years of age.

B. Protection of Contacts of a Case

1. **Identify individuals or groups with close contact** with the case. In healthcare settings control guidelines are more stringent—please refer to Section 4) C, subsection on healthcare settings [page 10]. As a general rule, "close contact" can be defined as:

   a. **Sharing indoor airspace** *for at least 10 hours per week.*
      - household contacts (including family daycare contacts)
      - sharing same classroom
      - extracurricular activities
      - bus or carpool contacts
      - work site, church, social contacts

      Less exposure may be significant for high-risk contacts, such as:
      - infants
      - underimmunized young children (see Section 4) B. 5 [page 6])
      - immunocompromised individuals
      - hospital room contacts (see specific instructions for healthcare settings, Section 4) C. [page 10])
      - pregnant women
      - individuals with chronic respiratory disease (including asthma)

   b. **Direct face-to-face contact** *regardless of the number of hours* per week spent together.
      - close friends
      - boyfriend/girlfriend
      - sport teammates
      - lunch partners
      - medical staff and their patients (see instructions for healthcare settings, Section 4) C. [page 10])
      - babysitters and the children they care for

   c. **Direct contact with respiratory/oral/nasal secretions of the case**.
      - sharing food, eating/drinking utensils
      - sharing lip gloss, lipstick, cigarettes, or similar items
      - kissing
      - medical/dental examination or procedure (suction, intubation, bronchoscopy, etc.) (see specific instructions for healthcare settings, Section 4) C. [page 10])

2. **Refer all high-risk contacts** (as defined above), whether they have symptoms or not, for medical evaluation.

3. **Identify symptomatic contacts** of those with close contact identified in Step 1 above. Questions to ask include:
   - Do you have cold symptoms (runny nose, sneezing); when did they start?
   - Do you have a cough; when did it start?
   - Describe your cough. (Ask open-ended question first; only proceed to the following if the interviewee does not give details.)

- Do you feel as if you are choking and cannot breathe?
- Do you cough at night or is coughing worse at night?
- Do you have coughing spells where you feel as if you cannot stop coughing?
- Do you vomit after coughing?

- Are there other people in your house (class, team, extracurricular group, worksite, close friends, etc.) with a cough?
  - How long have they been coughing?
  - What is their cough like?
  - Where do they work?

4. **Implement treatment/prophylaxis** of individuals with close contact to the case, as defined above, with the following provisos:
   a. If symptomatic people are already beyond their infectious period, which ends 21 days after cough onset, treatment is not of use. They should be referred for medical evaluation.
   b. For asymptomatic people, if their last exposure occurred > 21 days (one incubation period) ago, prophylaxis is not needed. However, for certain high-risk settings or individuals, MDPH may recommend extending the period for initiating prophylaxis to up to 42 days after last exposure.
   c. For asymptomatic people whose only relevant exposure was to an epidemiologically linked case (not laboratory-confirmed), prophylaxis recommendations depend on the setting:
      - In the outbreak setting (with $\geq$ 5 cases, at least one of which is laboratory-confirmed), prophylaxis may be considered.
      - Outside of the outbreak setting (including in the household of the epidemiologically linked case), prophylaxis is not *routinely* recommended; such contacts may wish to consult their providers. However, in certain high-risk settings (*e.g.*, some medical settings, residential schools for ill or handicapped children), the MIP may recommend prophylaxis of contacts.
   d. **Precaution when treating or prophylaxing newborns:** An association between orally administered erythromycin and infantile hypertrophic pyloric stenosis (IHPS) has been reported in infants < 6 weeks of age. Since confirmation of erythromycin as a contributor to cases of IHPS will require additional investigation, and since alternative therapies are not as well studied, erythromycin is still recommended for the prophylaxis and treatment of disease caused by *B. pertussis*. MIP recommends the following when administration of erythromycin to young infants is being considered:
      - Groups/individuals exposed to pertussis should be determined with precision in order to minimize unnecessary prophylaxis in infants.
      - Physicians who prescribe erythromycin to newborn infants should inform parents about the potential risks of developing IHPS and signs of IHPS, such as projectile vomiting or excessive irritability.
      - Cases of pyloric stenosis following use of oral erythromycin should be reported to MedWatch at 800-FDA-1088 (tel.) or 800-FDA-0178 (fax) and to the MIP at (617) 983-6800.

The earlier antibiotics are started, the more effective they are in preventing disease transmission from the case to the contact, as well as from the contact to others. Those with close contact with a confirmed case must take the antibiotics for the prescribed number of days; *if they do not, they must repeat the entire antibiotic course from the beginning.*

The recommendations for treatment of cases and prophylaxis of contacts to cases are identical. The symptoms of pertussis may be modified if treatment is begun early, during the catarrhal stage. If begun later in the course of illness, treatment will decrease the infectious period but may not decrease the duration of cough or severity of disease.

See treatment/prophylaxis schedule on the following page.

DRUG	CATEGORY	CHILD	ADULT
Erythromycin[1]	Drug of choice	40-50 mg/kg/day PO divided into 4 doses/day for 14 days (maximum: 2 gms per day)	250-500 mg PO 4 times/day for 14 days
Trimethoprim/ Sulfamethoxazole[2]	Alternative choice	8 mg TMP/40 mg SMX/kg/day PO divided into 2 doses/day for 14 days (maximum: 320 mg TMP/1600 mg SMX per day)	160 mg TMP/ 800 mg SMX PO 2 times/day for 14 days
Clarithromycin[3]	For those unable to tolerate erythromycin	15-20 mg/kg/day PO divided into 2 doses/day for 7 days (maximum: 1 gm/day)	500 mg PO 2 times/day for 7 days
Azithromycin[3]	For those unable to tolerate erythromycin	10-12 mg/kg/day PO given as 1 dose/day for 5 days (maximum: 600 mg)	500 mg PO given as 1 dose/day for 5 days

[1] Some authorities prefer the estolate preparation for children but recommend avoiding its use in adults.
[2] Not recommended for use in children < 2 months of age or pregnant women.
[3] The optimal duration of therapy has not been defined for these new macrolides. Studies suggest that the usual 5-day (azithromycin) to 7-day (clarithromycin) courses currently used may be effective, but this has not yet been definitively proven. These new macrolides are not recommended for use in children < 6 months of age or pregnant women.

The American Academy of Pediatrics (AAP) states that the macrolides clarithromycin and azithromycin can be alternatives for patients who cannot tolerate erythromycin. In addition, doxycycline is sometimes used if a patient is unable to tolerate the usual antibiotics, and some studies have shown it to be effective. However, doxycycline should be avoided in pregnant women and in children < 8 years old. For control purposes, it is reasonable to admit to school/work children/adults treated or prophylaxed with azithromycin, clarithromycin, or doxycycline, in addition to those treated with erythromycin or trimethoprim/sulfamethoxazole.

5. **Assess the immunization status of close contacts under age 7.** Contacts who are < 7 years of age and are unimmunized or have received fewer than five doses of DTP or DTaP should, in addition to receiving antibiotic prophylaxis, have pertussis immunization initiated or continued according to the following guidelines, as soon as possible after exposure:
   a. Give 1st dose at $\geq$ 6 weeks of age; doses 1, 2, and 3 must be separated by at least 4 weeks.
   b. Children who have received their third dose of DTP/DTaP $\geq$ 6 months before exposure should receive a fourth dose at this time.
   c. Children who have received four doses of DTP/DTaP should get a booster of DTP/DTaP, unless a dose has been given within the last three years.

6. **Exclude** cases, suspect cases, and contacts from school and work as follows:
   a. **Cases:**
      - If it is $\leq$ 21 days since cough onset: exclude through the first 5 days of the full course of appropriate antibiotics or, if not treated, for 3 weeks after cough onset.
      - If it is > 21 days since cough onset: they are no longer infectious, and no antibiotic treatment/exclusion is required.

b. **Symptomatic contacts:** Refer them to their healthcare provider. Exclusion requirements are the same as for a case (see immediately above), *regardless* of history of immunization, disease, symptoms, or laboratory test result.

c. **Asymptomatic contacts:** No exclusion is generally required except in healthcare settings, as described in Section 4) C., Healthcare Settings, 6. b. [page 10].If an asymptomatic contact becomes symptomatic, s/he should be treated as a case and excluded for the first 5 days of the full course of appropriate antibiotics. In certain situations deemed to be high-risk, MDPH may require exclusion of asymptomatic contacts not receiving antibiotic prophylaxis and/or may extend the exclusion period beyond 21 days up to a maximum of 42 days.

7. In institutional settings, **conduct systematic surveillance for cough illness** with active case finding and referral for medical evaluation, diagnostic testing, and antibiotic prophylaxis. In healthcare settings, surveillance should be initiated immediately after identification of a suspect case. Surveillance should continue through two incubation periods (42 days) after the date of cough onset in the last case. Please refer to Section 4) C., Schools, Instruction 8 [directly below] for specific recommendations for implementing active surveillance in institutions.

C. Managing Special Situations: Schools, Daycares, Healthcare Settings

Schools

Notify the local board of health and an immunization epidemiologist at MDPH (call 617-983-6800 or 888-658-2850 or your Regional Immunization Office). These staff can provide significant help with case investigation and outbreak control.

1. Initiate surveillance by considering the exposed groups addressed in Section 4) B. 1. a–c [page 4].

2. If the case is on any sports teams or in other extracurricular school groups, screen the other members for coughing. (These groups are an important mode of spread in middle and high schools.) Use questions listed in Section 4) B. 3 [page 4] to characterize cough.

3. Notify teachers who have a case in their classes to refer other coughing children to the nurse's office for evaluation. Use questions listed in Section 4) B. 3 [page 4] to characterize cough.

4. Notify other staff to refer any students who have been coughing for more than a week to the nurse's office. Use questions listed in Section 4) B. 3 [page 4] to characterize cough.

5. Determine whether there are any teachers (including student teachers) or staff who have been coughing. Use questions listed in Section 4) B. 3 [page 4] to characterize cough.

6. Refer symptomatic students, teachers, or other staff for medical evaluation and diagnostic testing (but testing is less important where there is a recognized outbreak underway). High-risk individuals should also be referred to their providers, *whether or not they have symptoms.*

7. Keep track of **symptomatic individuals** in a line listing of cases in tabular form, which should include location (in schools, grade and home room), cough duration, and what other symptoms are present (*i.e.*, whether the person meets the clinical case definition). On a separate list, keep track of the **groups exposed** (classrooms, teams, etc.), recording the total number of members, how many have had cough for 7–13 days, how many have had cough for $\geq$ 14 days, and how many have had $\geq$ 14 days of cough plus another pertussis symptom (*i.e.*, how many meet the clinical case definition). This will help in deciding whether whole groups need to be prophylaxed. MDPH provides a *Pertussis Surveillance Log Sheet* and a *Pertussis Surveillance Summary Sheet* for these purposes (Attachment B at the end of this chapter).

8. Send letters of notification to parents and staff. (MDPH provides model letters for various situations. These may be issued on the stationery of the MDPH, the local board of health, or the affected institution.) A different set of letters and alerts should go to each of the following:

a. Individual with symptoms (suspect case): letter to the suspect case or, if a child, to the parents/guardians; letter for healthcare provider of suspect case; *Pertussis Fact Sheet*
b. Asymptomatic individual with close contact as defined above (contact): letter to the contact or, if a child, to the parents/guardians; letter for health-care provider of contact; *Pertussis Fact Sheet* and/or *Alert*
c. Enrollee in an outbreak setting who has neither symptoms nor close contact with a confirmed case: *Pertussis Fact Sheet* and/or *Alert*
d. Staff in an outbreak setting who has neither symptoms nor close contact with a confirmed case: *Pertussis Fact Sheet* and/or *Alert* and control letter for staff.

It is helpful to telephone the contacts, especially the symptomatic ones, as well as sending the letters home.

9. Treat/prophylax *symptomatic and asymptomatic* contacts who have had close contact with a confirmed case, as defined in Section 4) B. 1. a–c [page 4], with the following *exceptions*:
   a. If symptomatic people are already beyond their infectious period, which ends 21 days after cough onset, treatment is not of use. They should be referred for medical evaluation.
   b. For asymptomatic people, if their last exposure occurred > 21 days (one incubation period) ago, prophylaxis is not needed. However, for certain high-risk settings or individuals, MDPH may recommend extending the period for initiating prophylaxis to up to 42 days after last exposure.
   c. For asymptomatic people whose only relevant exposure was to an epidemiologically linked case (not laboratory-confirmed), prophylaxis recommendations depend on the setting:
      - In the outbreak setting (with $\geq$ 5 cases, at least one of which is laboratory-confirmed), prophylaxis may be considered.
      - Outside of the outbreak setting (including in the household of the epidemiologically linked case), prophylaxis is not *routinely* recommended; such contacts may wish to consult their providers. However, in certain high-risk settings (*e.g.*, some medical settings, residential schools for ill or handicapped children), the MIP may recommend prophylaxis of contacts.

   Those with close contact to a confirmed case must take the antibiotics for the prescribed number of days; *if they do not, they must repeat the entire antibiotic course from the beginning.*

   Decisions about how widely to prophylax should depend on the number of cases, whether at least one is laboratory-confirmed, and the setting:

   d. **One laboratory-confirmed case:** Identify those with close contact as instructed in Section 4) B. 1. a–c [page 4]. Remember to consider any high-risk contacts, those individuals sharing indoor airspace for $\geq$ 10 hours per week, those with direct face-to-face contact, and those with direct contact with respiratory/oral/nasal secretions of the case.

      For classrooms, teams, and other groups in which there is one laboratory-confirmed case, it *may* be appropriate to prophylax the whole group, unless > 21 days have passed since cough onset in the last symptomatic person or the case was not present during his/her infectious period. The extent to which this recommendation is applied will vary according to the extent of exposure, the presence/absence of other coughing students, whether any other cases of pertussis have been reported in the area, and whether high-risk individuals or unvaccinated young children are present. Consult an Immunization Epidemiologist at MDPH or your local board of health if you are in doubt.

   e. **More than one confirmed case:** Identify those with close contact as instructed in Section 4) B. 1. a–c [page 4]. For classrooms, teams, and other groups in which there is more than one confirmed case, at least one of which is laboratory-confirmed, *it is appropriate to prophylax the entire group*, unless > 21 days have passed since cough onset in the last symptomatic person or the cases were not present during their infectious periods. Again, the extent to which this recommendation is applied will vary according to the extent of exposure, the presence/absence of other coughing students, whether there is any other reported pertussis in the area, and whether high-risk individuals or unvaccinated young children are

present. Consult an Immunization Epidemiologist at MDPH or your local board of health if you are in doubt.

Please consult Attachment C (at the end of this chapter) for a diagrammatic version of these recommendations.

10. Exclude cases and those with close contact, according to the guidelines in Section 4) B. 6 [page 6].

11. Continue cough surveillance for *2 incubation periods (42 days)* after the date of cough onset in the last case.

Daycare centers

1. Notify the local board of health and an immunization epidemiologist at MDPH (call 617-983-6800 or 888-658-2850 or your Regional Immunization Office). These staff can provide significant help with case investigation and outbreak control.

2. Initiate surveillance by considering the exposed groups addressed in Section 4) B. 1. a–c [page 4].

3. Because of the age, immunization status, and other risk factors of many daycare attendees, make a special effort to identify exposed individuals and groups who are at higher risk of developing complications from pertussis, including:
   - infants
   - underimmunized toddlers and preschoolers
   - pregnant teachers, staff, and volunteers
   - immunocompromised individuals
   - individuals with chronic respiratory disease (including asthma)

   These individuals should be referred to their providers, regardless of whether or not they have symptoms.

4. Review the immunization records of all enrollees. As stated above in Section 4) B. 5 [page 6], close contacts who are < 7 years old and have received fewer than five doses of DTP or DTaP should, in addition to receiving antibiotic prophylaxis, have pertussis immunization initiated or continued according to the following guidelines, as soon as possible after exposure:
   a. 1st dose should be given at $\geq$ 6 weeks of age; doses 1, 2, and 3 must be separated by at least 4 weeks.
   b. Children who have received their third dose of DTP/DTaP $\geq$ 6 months before exposure should receive a fourth dose at this time.
   c. Children who have received four doses of DTP/DTaP should get a booster of DTP/DTaP, unless a dose has been given within the last three years.

5. Follow Section 4) C, School settings, Instructions 4–12 [pages 7-9], taking note of the following:
   Precaution when treating or prophylaxing newborns: An association between orally administered erythromycin and infantile hypertrophic pyloric stenosis (IHPS) has been reported in infants < 6 weeks of age. Since confirmation of erythromycin as a contributor to cases of IHPS will require additional investigation, and since alternative therapies are not as well studied, erythromycin is still recommended for the prophylaxis and treatment of disease caused by *B. pertussis*. MIP recommends the following when administration of erythromycin to young infants is being considered:
   a. Groups/individuals exposed to pertussis should be determined with precision in order to minimize unnecessary prophylaxis in infants.
   b. Physicians who prescribe erythromycin to newborn infants should inform parents about the potential risks of developing IHPS and signs of IHPS, such as projectile vomiting or excessive irritability.
   c. Cases of pyloric stenosis following use of oral erythromycin should be reported to MedWatch at (800) FDA-1088 (tel.) or (800) FDA-0178 (fax) and to the MIP at (617) 983-6800.

Healthcare Settings

Due to the potential for transmission to individuals at high risk of complications from pertussis, exposure criteria and control measures in health care settings are **more rigorous** than in other settings.

1. Apply the control measures below to all patients, families, and staff in close contact with confirmed cases. In healthcare settings, "close contact" includes the following:
   a. having face-to-face contact, within 3 feet of the case, without wearing a surgical mask; *this includes conducting a medical examination, obtaining a nasopharyngeal culture, suctioning, intubating, performing bronchoscopy or similar procedure without wearing a mask*;
   b. conducting any procedure that induces coughing of the case, even if farther from the case than 3 feet, without wearing a surgical mask;
   c. coming into mucosal contact with respiratory, oral, or nasal secretions of the case directly or via fomites;
   d. sharing a room with the case; degree of contact and risk of infection in such situations should be evaluated on a case-by-case basis;
   e. having any other close contact to a case as defined in Section 4) B. 1. a–c [page 4].

2. Treat the case according to the schedule in Section 4) B. 4. [top of page 6]. Treatment is unnecessary if more than 21 days have elapsed since cough onset. Put the case in a private room, if available.

3. Give antibiotic prophylaxis to contacts of any confirmed case, as indicated:
   a. Contacts exposed within 21 days of their identification as contacts should receive antibiotic prophylaxis according to the schedule in Section 4) B. 4. [top of page 6] unless a specific medical contraindication exists. They and their providers should be notified of their contact with a confirmed case of pertussis.
   b. Asymptomatic contacts whose last exposure was more than 21 days before their identification as contacts, as well as their providers, should be informed of their exposure and given information on the symptoms of the disease. For certain high-risk settings or individuals, MDPH *may* recommend extending the period for initiating prophylaxis beyond 21 days up to a maximum of 42 days after last exposure.
   c. Please consult Section 4) B. 4 [page 5] for a fuller discussion of prophylaxis of contacts of epidemiologically linked cases.
   d. **Precautions when treating or prophylaxing newborns:** An association between orally administered erythromycin and infantile hypertrophic pyloric stenosis (IHPS) has been reported in infants < 6 weeks of age. Since confirmation of erythromycin as a contributor to cases of IHPS will require additional investigation, and since alternative therapies are not as well studied, erythromycin is still recommended for the prophylaxis and treatment of disease caused by *B. pertussis*. MIP recommends the following when administration of erythromycin to young infants is being considered:
      - Groups/individuals exposed to pertussis should be determined with precision in order to minimize unnecessary prophylaxis in infants.
      - Physicians who prescribe erythromycin to newborn infants should inform parents about the potential risks of developing IHPS and signs of IHPS, such as projectile vomiting or excessive irritability.
      - Cases of pyloric stenosis following use of oral erythromycin should be reported to MedWatch at (800) FDA-1088 (tel.) or (800) FDA-0178 (fax) and to the MIP at (617) 983-6800.

4. In addition to notifying providers, inform department heads, infection control, employee health, and other relevant personnel/departments of confirmed and suspect cases.

5. Test symptomatic contacts, in addition to giving prophylaxis. In selecting a diagnostic test, use the age and cough duration criteria shown in the table in Section 2) B. [page 2]. *If a serologic test is to be used, bear in mind that only tests performed at SLI are interpretable.*

6. Exclude close contacts as follows:
   a. **Staff, symptomatic:**
      - If it is ≤ 21 days since cough onset: exclude through the first 5 days of the full course of appropriate antibiotics or, if not treated, for 3 weeks after cough onset.
      - If it is > 21 days since cough onset: they are no longer infectious, and no antibiotic treatment/exclusion is required.
   b. **Staff, asymptomatic:**
      - If they are not on antibiotic prophylaxis, exclude for 21 days after their last exposure or, if unknown, for 21 days after the onset of the last case in the setting. (If their last exposure occurred > 21 days ago, prophylaxis/exclusion is generally not required.) However, in certain situations deemed to be high-risk, facilities may wish to exclude all asymptomatic healthcare workers, including those on antibiotics. In addition, MDPH may extend the exclusion period beyond 21 days up to a maximum of 42 days.
   c. **Outpatients, symptomatic:** Restrict from public activities for the first 5 days of the full course of antibiotic therapy.
   d. **Outpatients, asymptomatic:** No need to restrict their public activities.

7. Isolate all confirmed and suspect inpatient cases. They should be placed on droplet precautions until 5 days of the full course of antibiotic therapy have been completed.

8. Surveillance for cough illness should continue through two incubation periods (42 days) after the date of cough onset in the last case.

9. Prescribe antibiotic prophylaxis for all household contacts of diagnosed cases—there is great potential for silent transmission in families. Symptomatic contacts should be evaluated, placed on antibiotic therapy and excluded from activities for the first 5 days of therapy. Asymptomatic contacts need to receive antibiotic prophylaxis but do not need to restrict their public activities. However, if that asymptomatic contact is a healthcare worker not receiving antibiotic prophylaxis, they should be evaluated and excluded if indicated, as described in #6. b. directly above.

10. Assess the immunization status of close contacts under age 7 years. See Section 4) B. 5 [page 6] on starting or continuing DTP/DTaP immunization.

11. Continue cough surveillance for *two incubation periods (42 days)* after the date of cough onset in the last case.

D. Preventive Measures

Routine childhood vaccination and post-exposure antimicrobial prophylaxis are the best preventive measure against pertussis. Good personal hygiene (which consists of proper handwashing, disposal of used tissues, not sharing eating utensils, etc.) is also important. Please refer to the most current versions of the ACIP statement on pertussis (listed under References, below), MDPH's *Immunization Guidelines*, and MDPH's *Massachusetts Immunization Program-Supplied Vaccines and Patient Eligibility Criteria* for details about DTaP vaccine, the recommended schedule, who should and shouldn't get the vaccine, and who is eligible to receive state-supplied vaccine. These as well as other relevant resources are available through the Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850. A *Pertussis Public Health Fact Sheet* for the general public can also be obtained from the Division of Epidemiology and Immunization or through the MDPH website at <http://www.state.ma.us/dph/>. Click on the "Publications" link and scroll down to "Fact Sheets."

ADDITIONAL INFORMATION

The following are the Massachusetts and formal CDC surveillance case definitions for pertussis. They are provided for your information only; it is not necessary to use them for reporting or investigating a case. (CDC case definitions are used by the MDPH and CDC to maintain uniform standards for national reporting.) For reporting to the MDPH, always use the criteria outlined above in Section 2) A [page 2]. Note that the main

difference is that MDPH includes positive pertussis serology results at the SLI as constituting laboratory-confirmation, whereas CDC does not. In *practice,* however, CDC accepts SLI serology as confirmatory.

Case Definition for Pertussis (as defined in Massachusetts)

1. **Non-outbreak setting:**

a. An acute cough illness of any duration in an individual who is laboratory-confirmed by culture, **or**

b. A cough illness lasting $\geq$ 2 weeks with one or more of the following: paroxysms of coughing, inspiratory "whoop," or post-tussive vomiting, without other apparent cause, in an individual who is **laboratory-confirmed** by polymerase chain reaction (PCR) or serology performed at the SLI, **or**

c. A cough illness lasting $\geq$ 2 weeks with one or more of the following: paroxysms of coughing, inspiratory "whoop," or post-tussive vomiting, without other apparent cause, in an individual who is **epidemiologically linked** to a laboratory-confirmed case.

2. **Outbreak setting** (in institutional settings, $\geq$ 5 clustered cases whose cough onset dates are separated by < 42 days (2 incubation periods), at least one of which is laboratory-confirmed; in household settings, $\geq$ 1 case): A cough illness lasting $\geq$ 2 weeks (with or without additional symptoms) without other apparent cause, in an individual who is epidemiologically linked to a confirmed case.

Case Definition for Pertussis (as defined by CDC)

Clinical case definition:
A cough illness lasting $\geq$ 2 weeks with one of the following: paroxysms of coughing, inspiratory "whoop," or post-tussive vomiting, without other apparent cause.

Laboratory criteria for diagnosis:

- Isolation of *Bordetella pertussis* from clinical specimen or
- Positive polymerase chain reaction for *B. pertussis*

Case classification:
Probable: a case that meets the clinical case definition, is not laboratory-confirmed, and is not epidemiologically linked to a laboratory-confirmed case.
Confirmed: a case that is laboratory-confirmed or one that meets the clinical case definition and is either laboratory-confirmed or epidemiologically linked to a laboratory-confirmed case.

REFERENCES

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CDC. *Manual for the Surveillance of Vaccine-Preventable Diseases*. CDC, 1999.

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MDPH. *Regulation 105 CMR 300.000: Reportable Diseases and Isolation and Quarantine Requirements*. MDPH, Promulgated November 1998 (Printed July 1999).

Attachment A: Instructions for Filling out the Pertussis Case Report Form (3 pages)
Attachment B: Worksheets (3 pages)
Attachment C: Prophylaxis algorithms for a case/outbreak of pertussis in a child care or school setting (1 page)
Note: These attachments are separate PDF files. To access them, go back to the *Guide to Surveillance and Reporting* main page, and click on the P-R drop down menu. The attachments are listed under Pertussis.